# AIR FORCE LOGISTICS COMMAND

## MATERIEL MANAGEMENT ANALYSIS





THE AIR LOGISTICS EARLY REQUIREMENTS TECHNIQUE (ALERT)

FORECASTING MODEL USER'S GUIDE



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April 1989

AFLC

**COMBAT STRENGTH THROUGH LOGISTICS**
**LOGISTICS SUPPORT THROUGH ANALYSIS**

**HQ AFLC/MMIS WPAFB OH**

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This user's guide describes the Air Logistics Early Requirements Technique (ALERT) aircraft replenishment spares (BP15) Peacetime Operating Stock (POS) Program Objective Memorandum (POM) forecasting model. A description of the ALERT model, its inputs, and the procedures and outputs from the model are provided.

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SUBJECT: Final Report - ALERT Forecasting Model User's Guide

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1. In this report, we document a user's guide for the Air Logistics Early Requirements Technique (ALERT) for estimating Program Objective Memorandum (POM) inputs for the Peacetime Operation Spares (POS) portion of the aircraft replenishment spares budget (BP15). This user's guide provides the technical detail and procedures necessary for the BP15 program budget manager and/or budget analyst to run ALERT.

2. Our point of contact is Mr Rob Lucas, HQ AFLC/MMISA, AUTOVON 787-5249.

FOR THE COMMANDER

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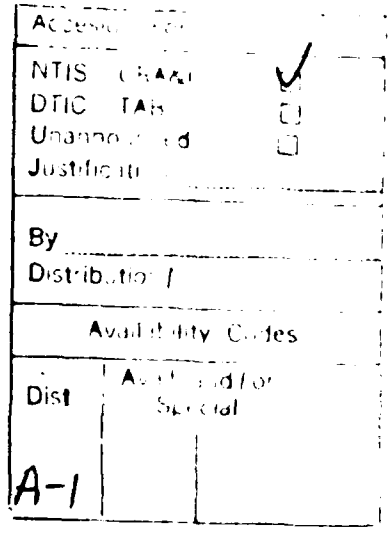
## ABSTRACT

This user's guide describes the Air Logistics Early Requirements Technique (ALERT) aircraft replenishment spares (BP15) Peacetime Operating Stock (POS) Program Objective Memorandum (POM) forecasting model. A description of the ALERT model, its inputs, and the procedures and outputs from the model are provided.



## EXECUTIVE SUMMARY

Headquarters Air Force Logistics Command (AFLC) uses the Air Logistics Early Requirements Technique (ALERT) forecasting model to project the Program Objective Memorandum (POM) outyear budget for the Peacetime Operating Stock (POS) portion of the aircraft replenishment spares (BP15) Budget Estimate Submission. The model resides on the Planning, Programming, Budgeting System (PPBS) Subproject 5 analysis and forecasting region of the Requirements Data Bank (RDB) computer system. The model is programmed in the SAS statistical programming language. ALERT can be accessed by the budget analyst and/or BP15 program manager through the RDB. This user's guide gives the technical detail and procedures necessary to run ALERT.

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# CHAPTER 1

# INTRODUCTION

In this report, we will explain how to run the Air Logistics Early Requirements Technique (ALERT) forecasting model. First we describe the model. Then we discuss the model inputs and how to gather them. In the final section, we describe the actual steps in running the ALERT model.

## Model Description

We describe the ALERT model in the last two year's ALERT forecast reports [1] and [2]. We repeat the description of the model here. Further updates in the description of the model will occur as we continue to document the annual ALERT forecasts.

ALERT is a multivariate regression based model that uses historical data to predict future Program Objective Memorandum (POM) requirements by weapon system. The model resides on the Planning, Programming, and Budgeting System (PPBS) Subproject 5 analysis and forecasting region of the Requirements Data Bank (RDB) computer system [3]. The model is programmed in the SAS statistical programming language. ALERT predicts the aircraft replenishment spares (BP15) Peacetime Operating Stock (POS) POM requirement. The model currently uses up to eleven years of historical data which includes the following:

1. Past Budget Estimate Submissions for the BP15 POS.

2. The sum of the D041 Central and Secondary Item Stratification (CSIS) extended year buy requirement plus the CSIS Approved Force Acquisition objective (AFAO) buy requirement for condemnations only (this is the estimate of recoverable buy requirements three to four years from the current June computation).

3. The reciprocal of the present and projected age of the fleet (developed by USAF/AC).

4. The dollar value of the fleet. This data was developed in the past by USAF/AC. Current efforts are underway in HQ AFLC/ACC to develop the data in-house.

ALERT is actually a five step process.

Step 1 - Update the ALERT Data Base - In this step, we collect the most up-to-date data on each of the variables. This includes updating the D041 Central and Secondary Item Stratification (CSIS) data and the age and value of the fleet data and entering them in the data base.

Step 2 - Develop Regression Equations - In this step, we run the ALERT model on the RDB computer which computes regression equations. Then we select the equations that result in the best fit of the data. The criteria used to determine the best fit consist of the following statistical tests: the adjusted r-square (the coefficient of determination), the F statistic, the residual pattern, and the Durbin-Watson test. We document these statistical techniques in chapter 3.

Each weapon system has its own regression equation and its own set of independent variables. We develop a different set of equations for the POM forecasts. We include the output of the first set of regression equations as historical data in developing the second set. (Using a regression forecast as another data point in developing yet another forecast is a statistical technique called bootstrapping.)

Step 3 - Management Review - The results of step 2 reflect the best set of regression equations and forecasts based on historical data. However, historical data is not always the best prediction of the future. This is because it assumes the forces at work in the past will continue in a predictable way into the future. Therefore, we include a management scrub which provides management a chance to look at the results and identify any known occurrence that would impact the future.

Step 4 - Develop New Regression Equations - We repeat step 2 with the data updated from the management scrub, and we include "dummy" variables to reflect future known occurrences. For example, if the budget program managers know of a significant modification or program change, we adjust the regression equation to account for the change.

Step 5 - Present the ALERT Forecasts - At this point, we present the ALERT forecasts by weapon system and total BP15 requirements to the budget program manager.

# CHAPTER 2

# MODEL INPUTS

This chapter provides the general information needed to gather the data for the ALERT BP15 POM forecasts. In it we provide what data is needed for the ALERT model, the timing of the data collection and the time frame of the forecast period, and how the CSIS data is gathered from the RDB computer system.

## Description of the ALERT Data

The data needed for the ALERT model is as follows:

1. The latest BP15 Peacetime Operating Stock (POS) Budget Estimate Submission (BES) numbers. We use the data from the weapon system summary tables as provided in the annual BP15 BES. The data is for the current year, the AY, BY and EY. We receive the data not earlier than 1 October annually. This data represents the dependent variable 'POSBES' which the ALERT model forecasts.

2. The aircraft fleet value numbers. This is the projected fleet value from the present through the POM outyears. Previously, UASF/AC provided the data. The data had to be developed manually this year. We have requested that AFLC/ACC provide the numbers not later than 1 August annually for the BP15 POM submission. This data represents the independent variable 'VALUE' in the ALERT model.

3. The fleet age numbers. This is the projected fleet age from the present through the POM outyears. Previously, USAF/AC provided the data. We had difficulty getting the data from Air Staff this year. To ensure that the data is made available to us in a timely manner, we requested AFLC/ACC to secure this resource for in-house (AFLC) use, or to develop the data in-house. We have requested that we receive the data not later than 1 August annually. We use the reciprocals of these numbers are used in the ALERT data base. This data represents the independent variable 'AGEREC' in the ALERT model.

4. D041 CSIS data. We use the restratified numbers for the 30 June CSIS cycle for the ALERT model. They are considered more accurate than the initial June CSIS products. This is because file maintenance is done on the data base between the initial and restratified CSIS runs. However, these numbers are generally not available until October/November. MMMRS keeps track of when the data base is loaded on the RDB. Sometimes the physical reports are produced before the June data base is loaded on the RDB. However, manually extracting the numbers from this report is time consuming and should be avoided if possible. We gather the data from the RDB

D041 budgeting data base from the T02 and T05 reports. We describe how to gather this data from the RDB at the end of this chapter. This data represents the independent variable 'TBUY' in the ALERT model.

5. System Management Code (SMC) data. A complete list of SMC codes used in last year's ALERT run is given to the BP15 budget manager to review and update in a timely manner before the CSIS data needs to be gathered. We have listed the current SMCs (the ones used in the 1988 ALERT forecasting analysis) in Appendix A.

6. We also maintain the following other variables in the ALERT model data base:

a. WSYS - this variable is not used by ALERT except to identify the data for the particular weapon system forecasted.
b. YEAR - (independent variable) - self explanatory.
c. AY - (independent variable) - the apportionment year deficit from the D041 CSIS.
d. BY - (independent variable) - the budget year deficit from the D041 CSIS.
e. DUMMY - (independent variable) - an inflation surrogate.
f. DUMMY2 - (independent variable) - a deflation surrogate.
g. FLTINV - (independent variable) - fleet inventory - used for the B-1 only as it was being introduced to the ALERT model data base.

## Timing of the ALERT Data

To enhance your understanding of what value ALERT forecasts, and how the model's results are applied, we present the following discussion. The timing cycles for budget reporting, for recomputing a new TBUY value (described below), for reviewing each fiscal year's BP15 budget requirements estimate across the POM and budget timeframes, and for the analysis steps (as discussed in the Model Description part of this report) all dramatically affect the usefulness, accuracy, and currency of the ALERT results. For instance, ALERT was originally developed as a POM forecasting tool. Now, because the budget timeframe was extended from one year to two years and because the POM exercises are conducted every two years instead of annually, ALERT also baselines the second year of the budget (See Figure 2-1). ALERT forecasts are annually updated to be more responsive to changes in the recoverable item CSIS results and other changes to input variables such as the value of the fleet or the inclusion of indicator variables. We hope to provide you a better appreciation for the timing dynamics inherent in the ALERT estimation process after you have read this part of the report.

Figure 2-1

BUDGET AND POM TIMING

- SEP 86 ALERT
  - -- NO 2-YEAR BUDGET
  - -- MMMI USED SEP 85 ALERT TO BASELINE FY88 BUDGET
  - -- MODEL FORECASTED FY89-93 POM

- SEP 87 ALERT
  - -- FIRST 2-YEAR BUDGET
  - -- MMMI USED SEP 86 ALERT TO BASELINE FY90 OF THE FY89/90 BUDGET
  - -- MODEL FORECASTED FY90-94 POM

- NO FY91-95 POM

- SEP 88 ALERT
  - -- MMMI USED SEP 87 ALERT TO BASELINE FY91 OF THE FY89/90 BUDGET
  - -- MODEL FORECASTED FY92-97 POM

## Budget Reporting

In any given year, a budget manager can look over ten years' worth of budget estimates. In addition to the three years of current program year funds s/he is managing, s/he can also look out seven years from today (See Figure 2-2). For the purposes of this example, we are assuming that the present FY is FY88. The budget manager is directly responsible for the FYs 1988 through 1990. The ALERT model's POSBES does not occur until four years from the present--in 1991. Then, ALERT-generated values are also used to estimate the BP15 POSBES from 1992 to 1997. The last POM year (1997) is ten years from the current FY.

Figure 2-2

BUDGET MANAGER'S VIEW OF ESTIMATES

| YEAR: | 1988 1989 1990 | 1991 | 1992 1993 1994 1995 1996 1997 |
|---|---|---|---|
| DATA FROM: | MMMIA HAS VALUES FROM BES AND AIR STAFF | ALERT RUN W/ TBUY | ALERT RUN WITH 1991 ALERT POSBES FORECAST ENTERED AS REAL POSBES VALUE |

## Recomputing a new TBUY value

The TBUY value is an independent variable in the regression against which ALERT forecasts the BP15 budget requirement. It is the sum of the CSIS extended year (EY) buy requirement (for repairs and condemnations) plus the Approved Force Acquisition Objective (AFAO) buy requirement for condemnations only. Figure 2-3 depicts where the EY and AFAO time periods fall in a look out from today. The CSIS values are used to "bootstrap" the ALERT model--and give the model's results more credibility because they are based upon the D041 recoverables computation (see Reference 1 for a description of bootstrapping).

FIGURE 2-3

BUDGET MANAGER'S PLANNING TIMEFRAMES

| APPORTIONMENT YEAR (AY) | BUDGET YEAR (BY) | EXTENDED YEAR (EY) | AIR FORCE ACQUISITION OBJECTIVE TIMEFRAME (AFAO) |
|---|---|---|---|
| THIS YEAR'S ESTABLISHED REQUIREMENT | THIS YEAR'S FORECASTED REQUIREMENT | WHAT THE BP MANAGER IS BUDGETING | WHAT THE BP MANAGER IS PLANNING FOR THE POM |
| TODAY | 0 TO 1 YRS OUT FROM TODAY | 1 TO 2 YRS OUT FROM TODAY | 3 TO 8 YEARS OUT FROM TODAY |

FY88 -------- FY89 ------------ FY90 ------------ FY91 ---------- FY97

|- N - O - W --|------ B - U - D - G - E - T ----------|---------- P - O - M ---------|

## Analysis steps

The ALERT analysis process typically begins in July and ends in December of each calendar year (see Figure 2-4). In July, we request updated data for the age of the fleet and the value of the fleet, or update it ourselves. This new data is then appended or overwritten to last year's ALERT data base. In August, the previous year's ALERT results are presented to the Air Staff as BES and POM forecasts. By September, the D041 June cycle item manager file maintenance and recoverables computation are completed; then the recoverables CSIS products and results are produced. The ALERT model's TBUY value is developed from the June final computation cycle CSIS results, generated in September. By early October, all the new data has been collected and entered in to the ALERT data base. Within three weeks, after updating the files, the ALERT forecasts are ready for input to the next FY's President Budget. ALERT-related activities continue into November and December with briefings and reports documenting this year's results and answering questions regarding the model (from Air Staff, auditors, other DCSs, etc.) The analysis process begins again in July of the subsequent year.

Figure 2-4

ANALYSIS TIMING

- JUNE/JULY
  - -- COMPLETE JUNE CSIS IM REVIEWS AND GENERATE COMP
  - -- RECEIVE MAR COMP DATA TO USE IN DEVELOPING THE BES
  - -- BEGIN COLLECTING OTHER DATA INPUTS (VALUE, AGE)

- AUG/SEP
  - -- IF A 'POM' YEAR, USE LAST YEAR'S ALERT TO PROVISIONALLY PRESENT POM ESTIMATES TO AIR STAFF
  - -- UPDATE DATA BASE WITH 'YEAR', 'VALUE', 'AGE' VALUES

- OCT
  - -- EACH YEAR, RUN ALERT TO BASELINE THE 2ND BUDGET YEAR
  - -- USE SEP COMP DATA TO DEVELOP 'TBUY' VALUE
  - -- PREPARE RESULTS

## Review of the BP15 Budget Requirements Estimate

Specifically, we will address how many times a given fiscal year's BP15 POS budget requirement estimate is formally reviewed and presented for Air Staff approval (see Figure 2-5). For example, the first time a BP15 POS budget requirement estimate (forecast) is presented is in the FY89 POM submission. The ALERT

model will estimate the POSBES number for FY96. The next time the BP15 FY96 POS budget requirement forecast is formally reviewed is in the FY90 POM , the third time will be in the FY91 POM, and the fourth time will be in the FY92 POM. In between these POM cycles, the estimates will be reported in the President's Budget reports, but the numbers will NOT be re-estimated. All of these bottom-line POM forecasts will be developed using the ALERT model. The first FY96 BES for BP15 will be in FY94. This "second year budget" estimate is baselined from the ALERT model's forecast, but the estimate is subject to a management scrub. The second FY96 BES will be in FY95 and is developed from the D041 CSIS results and management judgment. The actual budget execution, or spending of the FY96 BP15 budget will begin in FY96.

Figure 2-5

HOW OFTEN IS A FISCAL YEAR EXAMINED?

EXAMPLE: FY96

- FIRST POM LOOK IS IN FY89
- SECOND POM LOOK WILL BE IN FY90
- THIRD POM LOOK WILL BE IN FY91
- FOURTH POM LOOK WILL BE IN FY92
- 1ST BUDGET LOOK WILL BE IN FY94
- 2ND BUDGET LOOK WILL BE IN FY95
- ACTUAL BUDGET EXECUTION WILL BE IN FY96

## Gathering CSIS Data from the RDB

As your initial starting point, we assumed that you, the ALERT model user, will be accessing the RDB computer system through the Local Area Network (LAN). Using a Z-248, you can access the LAN by using your CALL program. At the LAN prompt, type "connect rdb" and the <return> key. Your screen should appear as follows:

```
You may now enter Net/One commands.
>>
>>    <--- This is a LAN prompt.
>>
>>connect rdb
  Connecting ... (3) 407720A2 Success.
```

Now hit the <return> key. This should bring up the prompt for the terminal type. Enter "rdbz248" and <return>.

```
ENTER TERMINAL TYPE: rdbz248
```

This should bring up the RDB access screen. Type "rdb" and <return> at the cursor as shown below:

```
ENTER APPLICATION REQUEST


          RRRRRRRRRR     DDDDDDDDD      BBBBBBB
          RR         RR  DD        DD   BB      BB
          RR         RR  DD         DD  BB      BB
          RRRRRRRRRR     DD         DD  BBBBBBBB
          RR       RR    DD         DD  BB      BB
          RR        RR   DD        DD   BB      BB
          RR         RR  DDDDDDDDD      BBBBBBB


rdb
```

This should bring up the RDB user-id screen. Enter your user-id and password: type "user-id" <tab> and "password" <return>. This is shown below:

```
                    WELCOME TO THE

            REQUIREMENTS DATA BANK SYSTEM  !


            PLEASE ENTER YOUR USERID AND PASSWORD.

                 USER-ID: user-id
                PASSWORD: password
```

This will bring up the current system news screen. Enter <return> to bring up the main menu. You should see the following screen:

```
                REQUIREMENTS DATA BANK MAIN MENU
          1. HELP              - THE RDB HELP SYSTEM
          2. NEWS              - GENERAL NEWS, AND INFORMATION
          3. ELECTRONIC MAIL   - SEND OR RECEIVE MAIL
          4. DISCREPANCY REPORT STATUS

     APPLICATION AREA:
          6. EOQ DEPOT DATA BANK        (D062DDB)
          7. EOQ CSIS                   (D062 CSIS)
          8. RECOVERABLE ITEMS          (D041)
          9. EQUIPMENT ITEMS            (D039)

     SYSTEM MANAGEMENT:
          20. PROGRAM DATA              (KOO4/G033J)
          21. FINANCIAL SYSTEMS
          22. RETAIL STOCK FUND         (D141A/B)


     ENTER SELECTION: XX
```

At the "XX" you should enter "8" or "08" for recoverable items. This will bring up the following screen:

```
                    REQUIREMENTS DATA BANK
                   MAIN MENU FOR D041 CSIS

      TYPE 'X' NEXT TO THE DESIRED SELECTION

        _ DIS DISPLAY

        _ DQ  DATA QUERY

        _ JS  JOB SUBMISSION



CMD:            F1=HELP F10=DONE MSG:
```

Enter an "X" at DIS DISPLAY and <return> or you can type "DIS" next to CMD: on the bottom line of the screen and <return>. This will bring up the following menu:

```
                    DISPLAY
               DIS  DISPLAY

      TYPE 'X' NEXT TO THE DESIRED SELECTION

        _ ACO  CURRENT ASSET CUTOFF DATE

        _ BUD  BUDGET PRODUCTS

        _ RPR  REPAIR PRODUCTS



CMD:            F1=HELP F10=DONE MSG:
```

If you want to see the dates of the latest data bases loaded for the D041 CSIS, type an "X" next to ACO and <return>. To return to the DISPLAY menu type <Esc> "0" (which corresponds to the 'F10=DONE') or enter "done" at the 'CMD:' line and <return>. Now enter an "X" next to BUD and <return>. This will bring up the following menu:

```
                              DISPLAY
                        BUD  BUDGET PRODUCTS

   TYPE 'X' NEXT TO THE DESIRED SELECTION

        _ S01  BUDGET ITEM DETAIL        _ T07  BP INS/NSO
        _ S04  BP                        _ T08  BP NEW
        _ S05  DIV BP                    _ T12  BP MMC/FSC
        _ S06  DIV IMS BP SMC            _ T13  TOTAL ITEMS
        _ S07  BP SMC                    _ T14  TOTAL BUY
        _ S08  DIV BP SMC                _ T15  TOTAL INS/NSO
        _ T01  MMC/FSC                   _ T16  TOTAL NEW
        _ T02  BP SMC                    _ T20  DIV IMS BP
        _ T03  BP SMC BUY                _ T21  DIV BP SMC MMC/FSC
        _ T04  BP SMC NEW                _ T22  DIV BP SMC
        _ T05  BP                        _ T23  DIV BP
        _ T06  BP BUY                    _ T24  DIV TOTAL


   CMD:              F1=HELP F10=DONE MSG:
```

Enter an "X" next to the T02 and <return>. The T02 report gives the necessary CSIS data by budget program (BP) and system management code (SMC). Enter a <tab> to bring up the screen below and fill in the necessary information. The screen should appear as follows:

```
PCN: A D041.-T02  CENTRAL SECONDARY ITEM STRATIFICATION  PROD RECS4160
PAGE:  1 OF 1              BUDGET SUMMARY  CUR DT/TIME: 30 NOV 88 07:48
__-MM POSITION-OP  FUNDING-FULL  PRICE-FORECASTED  AS OF DT: 30 JUN 88
BP-__  SMC-___
-----------------------(DOLLARS IN THOUSANDS)-----------------------


CMD:           F1=HELP F10=DONE MSG:
```

The previous screen is not aligned compared to the compressed computer screen, but all the information should be correct. You will need to be sure that all the underlined areas are correct. Tabbing will move you from underlined area to underlined area. If you make a mistake or miss an underlined area, keep tabbing until you return to the desired position. The following underlined areas must be filled in:

| | |
|---|---|
| __-MM | Enter "HQ" (Other selections are "OC," "OO," "SA," "SM," and "WR") |
| POSITION-OP | Enter "AY," "BY," or "EY" |
| FUNDING-FULL | Leave alone |
| PRICE-FORECASTED | Leave alone |
| AS OF DT:30 JUN 88 | Should be JUN or appropriate cut off date |
| BP-__ | Enter "15" |
| SMC-____ | Enter appropriate four letter code |

After you have entered all the appropriate information, enter <return> for the computer to call the information to the screen. For each SMC in BP15, you will need:

in AY: Total apportionment year deficit (row 13, column 9)
in BY: Total budget year deficit (row 13, column 9)
in EY: Total extended year deficit plus on-order commit plus on-order contract (row 13, columns 7, 8 and 9)

When you are finished gathering data, enter <Esc> and "0." This will return you to the DISPLAY menu. Select the T05 report and gather the data as you did from the T02 report. Note the 'SMC-___' line is missing. The T05 data gives you the summation of CSIS data across all SMCs for the BP. The total T05 data minus the total of the T02 data yields the CSIS data for the 'other' weapon systems we forecast.

When you are finished gathering data, enter <Esc> and "0" until you return to the RDB screen.

# CHAPTER 3

## RUNNING THE ALERT MODEL

This chapter contains the procedures for running the ALERT BP15 POM forecasting model on the Requirements Data Bank's Subproject 5 analysis and forecasting region. We present our assumptions made for these procedures and then present them in a step by step fashion.

### Assumptions

We make the following assumptions about the user running the ALERT model.

1. It is assumed that the user has a working knowledge of the ROSCOE on-line program development system. The user should know how to save, retrieve, and edit program data sets using ROSCOE.
2. It is assumed that the user has an RDB ROSCOE user-id and password. If they do not, a user-id and password can be obtained from HQ AFLC/MMISA.
3. It is assumed that the user has a fundamental understanding of the multivariate regression and bootstrapping techniques used in ALERT.
4. It is assumed that the user has a statistical background from which he can interpret the results of the model.
5. It is assumed that the user has gathered the necessary data to update the data bases used in ALERT.
6. A working knowledge of the SAS programming language would be appropriate but not totally necessary for running the model.

## Procedures

Running the ALERT forecasting model involves the updating and running of seven different programs. We list the programs in the Table 3-1.

ALERT PROGRAM NAMES

| PROGRAM NAME | DESCRIPTION |
|---|---|
| RLA.ALERTDB | UPDATES ALERT DATA BASE |
| RLA.ALERT1A | ALERT MODEL PART 1 - STEP A |
| RLA.ALERT1B | ALERT MODEL PART 1 - STEP B |
| RLA.ALERT1C | ALERT MODEL PART 1 - STEP C |
| RLA.ALERT2A | ALERT MODEL PART 2 - STEP A |
| RLA.ALERT2B | ALERT MODEL PART 2 - STEP B |
| RLA.ALERT2C | ALERT MODEL PART 2 - STEP C |

Table 1

The RLA.ALERTDB program is used to update the ALERT's data bases. RLA.ALERT1A, RLA.ALERT1B, and RLA.ALERT1C are used in the initial bootstrapping run of the ALERT model. RLA.ALERT2A, RLA.ALERT2B, and RLA.ALERT2C are used to make the ALERT projections for the POM outyears. The following steps describe how to run the ALERT forecasting model.

Step 1 - Getting onto the ROSCOE on-line program development system on the RDB.

As your initial starting point, we assumed that you, the prestigious ALERT model user, will be accessing the RDB computer system through the Local Area Network (LAN). Using your Z-248, you can access the LAN by using your CALL program. At the LAN prompt, type "connect rdb" and the hit the <return> key. Your screen should appear as follows:

```
You may now enter Net/One commands.
>>
>>    <--- This is a LAN prompt.
>>
>>connect rdb
  Connecting ... (3) 407720A2 Success.
```

Now hit the <return> key. This should bring up the prompt for the terminal type. Enter "rdbz248" and <return>.

```
ENTER TERMINAL TYPE: rdbz248
```

This should bring up the RDB access screen. Type "roscoe" and <return> at the cursor as shown below:

```
ENTER APPLICATION REQUEST


                RRRRRRRRRR      DDDDDDDDD       BBBBBBB
                RR         RR   DD        DD    BB      BB
                RR         RR   DD         DD   BB      BB
                RRRRRRRRRR      DD         DD   BBBBBBBB
                RR       RR     DD         DD   BB      BB
                RR        RR    DD        DD    BB      BB
                RR         RR   DDDDDDDDD       BBBBBBB
```

roscoe

This should bring up the ROSCOE access screen. Enter your user-id and password: type "user-id" <tab> and "password" <return>. This is shown below:

```
KEY      user-id

PASSWORD password
```

This will bring up a compressed font version of the Active Work Space (AWS) screen. To return the AWS screen to a normal width, enter "mod 2" and <return>.

Step 2 - Updating the ALERT data bases.

The top of your computer screen should now appear as follows:

(These top three blank lines are the command section of the screen.)

```
>
> AWS()                  SCRL FULL COLS 00001 00072 PAU(   .SYNON)
>
<...+....1....+....2....+....3....+....4....+....5....+....6....+..
```

Fetch the program RLA.ALERTDB to your AWS. Enter "fetch rla.alertdb & attach" and <return> in the command section of your

screen. If you are using the 'ppb5rla' user-id, you will not need to enter the prefix "rla." Your screen should now appear as follows:

```
>
> AWS(RLA.ALERTDB)     SCRL FULL COLS 00001 00072 PAU(    .SYNON)
>
<...+....1....+....2....+....3....+....4....+....5....+....6....+..
 ......  ============================== T O P =====================
 000100  //PPB5RLA2  JOB (00000,LCA),'BIN84 LUCAS 75249',
 000200  //     CLASS=A,MSGCLASS=X,NOTIFY=ROS1RLA
 000300  //SAS        EXEC PROC=SAS,WORK='50,10'
 000400  //ALERTDB    DD DSN=PPB5GRP.ALERT.JUN88,DISP=(OLD,CATLG,KEEP),
 000500  //              UNIT=PPB5,SPACE=(CYL,(30,30),RLSE)
 000600  //SYSPRINT   DD   SYSOUT=*
 000700
 000800        /************************************/
 000900        /*         PROGRAM: ALERTDB         */
```

The bold printing needs to be updated. The 'RLA' in 'PPB5RLA2' and 'ROS1RLA' should be the last three letters of your user-id. The '2' in 'PPB5RLA2' can be any number or letter of your choice. The 'PPB5RLA2' is the job identification number. After you have submitted the program, the 'ROS1RLA' notifies you when your job is finished. The 'BIN84 LUCAS 75249' is for further identification of your job. 'BIN84' identifies the bin the job should be routed to when it is completed. The other two are your name and phone extension. The 'PPB5GRP.ALERT.JUN88' identifies the SAS data set that the SAS programming language is to create when the job is run.

The 'JUN88' identifies this data base as being updated with June 1988 data. Enter an appropriate string to replace 'JUN88,' i.e., 'JUN89.'

After you have completed these initial efforts, you will want to update the data base in the RLA.ALERTDB program. On the following page is an example of the FY88 A-7 aircraft data. We added the column markings above the data for clarity.

```
   A     B     C     D        E       F       G       H     I    J K   L

003700      CARDS;
003800 A7    78  14269    7342    53001    7.0    1958   .17   0 0    _
003900 A7    79 .......
  .
  .
  .
004800 A7    88  16180   15753   415200   14.2    3431  .069  0 0    _
004900 A7    89   3102   24050    66678    9.6    3522  .070  0 0    _
005000 A7    90   7207    8646   166060   15.7    3585  .065  0 0    _
005100 A7    91 .......
   .
   .
   .
005600 A7    96      0       0        0      _     1442  .047  0 0    _
005700 A7    97      0       0        0      _     1477  .045  0 0    _
005800 .......
```

If we were updating this June 1988 data base for the FY89 ALERT POM run, we would not modify any of the history data (anything up to and including 1988). We would only modify those data lines from 1989 on. In addition, we would also add a line of data for the last POM outyear, FY98.

The definitions for the columns of data are:

Column A - the program line numbers
Column B - weapon system
Column C - year
Column D - AY deficit
Column E - BY deficit
Column F - EY total CSIS buy (on-order contract, commit, and deficit)
Column G - BP15 POS BES
Column H - fleet value
Column I - fleet age reciprocal
Column J - inflation surrogate
Column K - deflation surrogate
Column L - fleet inventory

When you have completed updating the data bases, you will need to save this updated program for future use and/or reference. If you are using the 'ppb5rla' user-id, you will enter "update *" (or the asterisk can be the name of the user file: alertdb). If you are using a different user-id you will want to save the file under your own user-id. The first tire you save it you will enter "save

alertdb" (or some other unique file name. We recommend, however, that for consistency you should use the same file names that are used in this report). You do not need to add the prefix, as ROSCOE will automatically put the last three letters/numbers of your user-id as a prefix to the file you are saving. After the file has been saved for the first time, you can update the existing file by entering "update alertdb."

Now submit this program to the job stream. Enter "sub" and <return> in the command section of the screen. Enter "dis ppb*" to get an update of the job status; or you may periodically hit your return key and look for the computer's notification of the job's completion.

When the job run is completed, attach the job for viewing on your PC computer screen. Enter "attach job ppb5rla2" and <return>. The first of five job output files will be attached to your screen. You may view each of the files by entering "prev file" and <return> or "next file" and <return>.

To print the job files, while the job is still attached, enter "status" and <return>. Something similar to the following screen will appear:

```
>
> STA(PPB5RLA2,####)  SCRL FULL COLS 00001 00072 PAU(   .SYNON)
>
<...+....1....+....2....+....3....+....4....+....5....+....6....+..
                          ROSCOE ALTER/STATUS PROCESSOR
 JOB NAME     NO    FILE    LINE    PAGE/   LINE  FIND LIMIT I/O CO
 PPB5RLA2   2238       4       1       1      1        6000

 (1)          (2) (3)                (4)   (5)
  A  FILE STA C  DEST         LINES FORM  CPY NOTES
  _     1 NOP X  LOCAL           17 STD     1 JES2.$JES2LOG
  _     2 NOP X  LOCAL           43 STD     1 JES2.$JCLIMG
  _     3 NOP X  LOCAL           98 STD     1 JES2.$SYSMSGS
  _     4 NOP X  LOCAL          364 STD     1 STATS.SAS.FT11F001
  _     5 NOP X  LOCAL         1784 STD     1 STATS.SAS.FT1
 ============================ END OF OUTPUT FILES ================
```

The first three files are JCL files. The fourth is the program's SAS source code, and the fifth is the program output. You will probably only want the fourth and fifth files. In column (1), enter a "P" (for "Print") next to FILE lines 4 and 5. Then detach the job by entering "detach job" at the top of the screen and <return>. The listings will print out in the computer room in the basement of the building and will be routed to your program listings pickup bin. If you want to print the program out at the AFLC/MMM Lee printer, you may enter the following code under column (3) on the last two lines: "U721 " to print on the Lee printer at

post 106R.

If for some reason you make an error in the ALERT data base (i.e., loading bad data), you can correct this in the following manner. First load the RLA.ALERTDB file into your AWS space and make the necessary corrections to the file. Then you can rerun the program which will recreate your data base.

You are now ready for your first bootstrap run of the ALERT model.

Step 3 - First part of the ALERT model run - Step A.

The first part of the ALERT model run is to select the last POS BES value before the POM outyears. Step A computes all the possible R-square values for all combinations of the regression variables. From these you will select a "library" of possible regression equations to model in step 4. The main SAS procedure executed for each weapon system is as follows:

```
PROC RSQUARE CP;
    MODEL POSBES = TBUY DUMMY DUMMY2 VALUE YEAR AGEREC;
```

Fetch the first ALERT model, RLA.ALERT1A, to your AWS computer space. Your computer screen should appear as follows:

```
>
> AWS(RLA.ALERT1A)     SCRL FULL COLS 00001 00072 PAU(    .SYNON)
>
<...+....1....+....2....+....3....+....4....+....5....+....6....
 ......  ============================== T O P ================
 000100  //PPB5RLA2  JOB (00000,LCA),'BIN84 LUCAS 75249',
 000200  //     CLASS=A,MSGCLASS=X,NOTIFY=ROS1RLA
 000300  //STATS      EXEC PROC=SAS,WORK='50,10'
 000400  //ALERTDB    DD DSN=PPB5GRP.ALERT.JUN88,DISP=SHR
 000500  //SYSPRINT   DD   SYSOUT=*
 000600
 000700       /*****************************************/
 000800       /*                                       */
 000900       /*          FIRST ALERT PROGRAM          */
 000000       /*                STEP A                 */
 001100       /*              (ALERT1A)                */
 001200       /*                                       */
 001300       /*****************************************/
```

You will need to update the bold characters as you did in step 2. No further modifications are necessary unless you are adding or deleting weapon systems from the ALERT model runs.

Submit this program to the job stream as you did in step 2.

On the following two pages is the output for RLA.ALERT1A, Step A for FY88. Your objective is to select the models that have a high R-square and a C(P) value that approaches the number of variables in the model. For each type of model (i.e., one variable, two variables, three variables, etc.), there appears to be a natural break where the R-square and C(P) values suddenly change and get worse. These natural breaks are indicated by the straight lines that we've drawn. Note that R-square is the coefficient of determination and C(P) is Mallow's Cp statistic. R-square is interpreted as being the percentage of the total variation in the dependent variable that can be explained by the model (regression equation) [4]. For Mallow's statistic, when the right model is chosen, the parameter estimates are unbiased, and this is reflected in Cp being near to the number of variables in the model [5].

Those models below the lines are candidates for input in Step B (Step 4). We further narrowed the possible models to those indicated by the asterisks (*). Since the A-7 data base has nothing but zeros for the DUMMY2 variable, this variable is meaningless in the regression equations. Therefore, we eliminated all models that have this variable in it. Also, no regression equations can be dependent on the variables DUMMY and/or DUMMY2 alone. Therefore, we eliminated all such type models. The models with the asterisks are the ones that become the input to the next step.

N=13 REGRESSION MODELS FOR DEPENDENT VARIABLE: POSBES MODEL: MODEL1

| NUMBER IN MODEL | R-SQUARE | C(P) | VARIABLES IN MODEL |
|---|---|---|---|
| 1 | 0.00000000 | 98.462837 | DUMMY2 |
| 1 | 0.00003483 | 98.459094 | AGEREC |
| 1 | 0.00226096 | 98.219867 | VALUE |
| 1 | 0.04903918 | 93.192947 | YEAR |
| 1 | 0.08959468 | 88.834739 | TBUY |
| 1 | 0.78455627 | 14.152195 | DUMMY |
| 2 | 0.00003483 | 100.459 | DUMMY2 AGEREC |
| 2 | 0.00226096 | 100.220 | DUMMY2 VALUE |
| 2 | 0.02525037 | 97.749360 | VALUE AGEREC |
| 2 | 0.04903918 | 95.192947 | DUMMY2 YEAR |
| 2 | 0.08959468 | 90.834739 | TBUY DUMMY2 |
| 2 | 0.09646404 | 90.096538 | TBUY YEAR |
| 2 | 0.10366295 | 89.322922 | TBUY VALUE |
| 2 | 0.11821102 | 87.759545 | TBUY AGEREC |
| 2 | 0.26975269 | 71.474447 | VALUE YEAR |
| 2 | 0.47208900 | 49.730813 | YEAR AGEREC |
| 2 | 0.78455627 | 16.152195 | DUMMY DUMMY2 |
| 2 | 0.78484700 | 16.120952 | * DUMMY VALUE |
| 2 | 0.78568832 | 16.009048 | * DUMMY AGEREC |
| 2 | 0.78819324 | 15.761356 | * TBUY DUMMY |
| 2 | 0.78960906 | 15.609207 | * DUMMY YEAR |
| 3 | 0.02525037 | 99.749360 | DUMMY2 VALUE AGEREC |
| 3 | 0.09646404 | 92.096538 | TBUY DUMMY2 YEAR |
| 3 | 0.10366295 | 91.322922 | TBUY DUMMY2 VALUE |
| 3 | 0.11821102 | 89.759545 | TBUY DUMMY2 AGEREC |
| 3 | 0.13775907 | 87.658856 | TBUY VALUE AGEREC |
| 3 | 0.26975269 | 73.474447 | DUMMY2 VALUE YEAR |
| 3 | 0.34248229 | 65.658718 | TBUY VALUE YEAR |
| 3 | 0.47208900 | 51.730813 | DUMMY2 YEAR AGEREC |
| 3 | 0.47385571 | 51.540958 | VALUE YEAR AGEREC |
| 3 | 0.56015562 | 42.266925 | TBUY YEAR AGEREC |
| 3 | 0.78484700 | 18.120952 | DUMMY DUMMY2 VALUE |
| 3 | 0.78568832 | 18.009048 | DUMMY DUMMY2 AGEREC |
| 3 | 0.78819324 | 17.761356 | TBUY DUMMY DUMMY2 |
| 3 | 0.78845211 | 17.733536 | * TBUY DUMMY VALUE |
| 3 | 0.78960906 | 17.609207 | DUMMY DUMMY2 YEAR |
| 3 | 0.79050637 | 17.512779 | * TBUY DUMMY YEAR |
| 3 | 0.79438181 | 17.096314 | * TBUY DUMMY AGEREC |
| 3 | 0.81484444 | 14.897342 | * DUMMY VALUE YEAR |
| 3 | 0.82522497 | 13.781021 | * DUMMY VALUE AGEREC |
| 3 | 0.91743691 | 3.872464 | * DUMMY YEAR AGEREC |
| 4 | 0.13775907 | 89.658856 | TBUY DUMMY2 VALUE AGEREC |
| 4 | 0.34248229 | 67.658718 | TBUY DUMMY2 VALUE YEAR |
| 4 | 0.47385571 | 53.540958 | DUMMY2 VALUE YEAR AGEREC |
| 4 | 0.56015562 | 44.266925 | TBUY DUMMY2 YEAR AGEREC |
| 4 | 0.56298296 | 43.963091 | TBUY VALUE YEAR AGEREC |
| 4 | 0.78845211 | 19.733536 | TBUY DUMMY DUMMY2 VALUE |

↑ R-SQUARE SUDDENLY DEGRADES AT THIS POINT. C(P) SUDDENLY INCREASES.

AIR LOGISTICS EARLY REQUIREMENTS TECHNIQUE
A-7 POM FORECAST
BP15 POS

16:11 WEDNESDAY, NOVEMBER 16, 1988

| NUMBER IN MODEL | R-SQUARE | C(P) | VARIABLES IN MODEL |
|---|---|---|---|
| 4 | 0.79050637 | 19.512779 | TBUY DUMMY DUMMY2 YEAR |
| 4 | 0.79438181 | 19.096314 | TBUY DUMMY DUMMY2 AGEREC |
| 4 | 0.81464444 | 16.897342 | DUMMY DUMMY2 VALUE YEAR |
| 4 | 0.81902149 | 16.448464 | * TBUY DUMMY VALUE YEAR |
| 4 | 0.82522497 | 15.781821 | DUMMY DUMMY2 VALUE AGEREC |
| 4 | 0.83132937 | 15.125824 | * TBUY DUMMY VALUE AGEREC |
| 4 | 0.91743691 | 5.872464 | DUMMY DUMMY2 YEAR AGEREC |
| 4 | 0.92404140 | 5.162727 | * DUMMY VALUE YEAR AGEREC |
| 4 | 0.92981643 | 4.542126 | * TBUY DUMMY YEAR AGEREC |
| 5 | 0.56298296 | 45.963091 | TBUY DUMMY2 VALUE YEAR AGEREC |
| 5 | 0.81902149 | 18.448464 | TBUY DUMMY DUMMY2 VALUE YEAR |
| 5 | 0.83132937 | 17.125824 | TBUY DUMMY DUMMY2 VALUE AGEREC |
| 5 | 0.92404140 | 7.162727 | DUMMY DUMMY2 VALUE YEAR AGEREC |
| 5 | 0.92981643 | 6.542126 | TBUY DUMMY DUMMY2 YEAR AGEREC |
| 5 | 0.93486120 | 6.000000 | * TBUY DUMMY VALUE YEAR AGEREC |
| 6 | 0.93486120 | 6.000000 | TBUY DUMMY DUMMY2 VALUE YEAR AGEREC |

Step 4 - First part of the ALERT model run - Step B.

As we stated in step 3, the first part of the ALERT model run is to select the last POS BES value before the POM outyears. Step B computes all the regression equations for all the models we selected in step 3. This creates a "library" of possible regression equations to model from which to select the POS BES value.

Fetch the ALERT model, RLA.ALERT1B, to your AWS computer space. Your computer screen should appear as follows:

```
>
> AWS(RLA.ALERT1B)     SCRL FULL COLS 00001 00072 PAU(    .SYNON)
>
<...+....1....+....2....+....3....+....4....+....5....+....6....+..
 ......  ============================== T O P ====================
 000100  //PPB5RLA2  JOB (00000,LCA),'BIN84 LUCAS 75249',
 000200  //     CLASS=A,MSGCLASS=X,NOTIFY=ROS1RLA
 000300  //STATS      EXEC PROC=SAS,WORK='50,10'
 000400  //ALERTDB    DD DSN=PPB5GRP.ALERT.JUN88,DISP=SHR
 000500  //SYSPRINT   DD   SYSOUT=*
 000600
 000700       /*****************************************/
 000800       /*                                       */
 000900       /*          FIRST ALERT PROGRAM          */
 000000       /*                STEP B                 */
 001100       /*              (ALERT1B)                */
 001200       /*                                       */
 001300       /*****************************************/
```

You will need to update the bold characters as you did in step 2.

The main SAS procedure executed for each weapon system is as follows:

```
PROC REG;
    ID YEAR;
    MODEL POSBES = TBUY DUMMY DUMMY2 VALUE YEAR AGEREC
       / P R CLI CLM DW;
```

The third line is the one you will vary for each model. Further modifications may be necessary as you incorporate the different ALERT models you selected in the last step into this ALERT program. You may need to add or delete PROC REGs as necessary.

When you have completed making changes, submit this program to the job stream and output it as you did in step 2. An example of the output for the A-7 aircraft is included on the next two pages.

There are five criteria from which you can decide which is the optimum model to use to select the last POS BES value before the POM outyears. They are: the adjusted R-square value, the F statistic, the residual pattern, the Durbin-Watson statistic, and subjective judgement. The R-square statistic was described in step 3. The F value (denoted by 'F VALUE' on the SAS output) ought to be such that the probality (denoted by 'PROB>F' on the SAS output) of exceeding it is very small. The residual pattern (the difference between the predicted and actual value) ought to be small also. The Durbin-Watson statistic measures autocorrelation and generally should approach the value of 2 (see reference [6] for more detail). If the other tests are reasonable, subjective judgement plays heavily in the decision making as knowledge of future trends and circumstances not reflected in historical data will determine which model is the best to use. In the A-7 example, the $9.35 million was the predicted value used for the last POS BES value before the FY92 to FY97 POM outyears.

AIR LOGISTICS EARLY REQUIREMENTS TECHNIQUE
A-7 PUM FORECAST
BP15 POS

16:11 WEDNESDAY, NOVEMBER 16, 1988

DEP VARIABLE: POSBES BP15 POS BES

ANALYSIS OF VARIANCE

| SOURCE | DF | SUM OF SQUARES | MEAN SQUARE | F VALUE | PROB>F |
|---|---|---|---|---|---|
| MODEL | 5 | 2571.99733 | 514.39947 | 20.093 | 0.0005 |
| ERROR | 7 | 179.21036 | 25.60148027 | | |
| C TOTAL | 12 | 2751.20769 | | | |

| | | | |
|---|---|---|---|
| ROOT MSE | 5.059791 | R-SQUARE | 0.9349 |
| DEP MEAN | 22.53077 | ADJ R-SQ | 0.8883 |
| C.V. | 22.45725 | | |

PARAMETER ESTIMATES

| VARIABLE | DF | PARAMETER ESTIMATE | STANDARD ERROR | T FOR H0: PARAMETER=0 | PROB > \|T\| | VARIABLE LABEL |
|---|---|---|---|---|---|---|
| INTERCEP | 1 | 493.66371 | 124.48110 | 4.006 | 0.0052 | INTERCEPT |
| TBUY | 1 | -0.000018273 | 0.000016946 | -1.078 | 0.3166 | EY TOTAL CSIS BUY |
| DUMMY | 1 | 20.60929948 | 4.52561588 | 6.322 | 0.0004 | INFLATION SURROGATE |
| VALUE | 1 | -0.007336057 | 0.009963518 | -0.736 | 0.4855 | FLEET VALUE |
| YEAR | 1 | -4.82814163 | 1.38752413 | -3.336 | 0.0125 | AY YEAR |
| AGEREC | 1 | -691.55105 | 196.00464 | -3.528 | 0.0096 | FLEET AGE RECIPROCAL |

| OBS | ID | ACTUAL | PREDICT VALUE | STD ERR PREDICT | LOWER95% MEAN | UPPER95% MEAN | LOWER95% PREDICT | UPPER95% PREDICT | RESIDUAL | STD ERR RESIDUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | . | . | . | . | . | . | . | . | . | . |
| 2 | 78 | 7.0000 | 4.7725 | 4.5435 | -5.9713 | 15.5162 | -11.3079 | 20.8529 | 2.2275 | 2.2267 |
| 3 | 79 | 14.5000 | 19.6137 | 2.8422 | 12.8929 | 26.3344 | 5.8907 | 33.3366 | -5.1137 | 4.1861 |
| 4 | 80 | 21.1000 | 20.2516 | 2.3088 | 14.6505 | 25.8531 | 7.0410 | 33.4626 | 0.8482 | 4.4711 |
| 5 | 81 | 30.7000 | 27.7753 | 3.2615 | 20.0631 | 35.4874 | 13.5405 | 42.0100 | 2.9247 | 3.8684 |
| 6 | 82 | 48.2000 | 52.6526 | 3.5924 | 44.1579 | 61.1473 | 37.9791 | 67.3261 | -4.4526 | 3.5632 |
| 7 | 83 | 57.3000 | 52.8474 | 3.5924 | 44.3527 | 61.3421 | 38.1739 | 67.5209 | 4.4526 | 3.5632 |
| 8 | 84 | 28.4000 | 22.8945 | 2.4039 | 17.2102 | 28.5787 | 9.6482 | 36.1407 | 5.5055 | 4.4523 |
| 9 | 85 | 20.3000 | 22.7118 | 2.2214 | 17.4590 | 27.9645 | 9.6449 | 35.7786 | -2.4118 | 4.5461 |
| 10 | 86 | 11.8000 | 13.8908 | 4.5891 | 3.0392 | 24.7423 | -2.2618 | 30.0434 | -2.0908 | 2.1311 |
| 11 | 87 | 14.2000 | 15.5413 | 4.8677 | 4.0308 | 27.0517 | -1.0612 | 32.1438 | -1.3413 | 1.3808 |
| 12 | 88 | 9.6000 | 15.9227 | 2.6784 | 9.5892 | 22.2562 | 2.3851 | 29.4602 | -6.3227 | 4.2927 |
| 13 | 89 | 15.7000 | 12.4741 | 2.7152 | 6.0536 | 18.8946 | -1.1044 | 26.0525 | 3.2259 | 4.2696 |
| 14 | 90 | 14.1000 | 11.5518 | 3.5799 | 3.0867 | 20.0169 | -3.1040 | 26.2082 | 2.5482 | 3.5758 |
| 15 | 91 | . | 9.3494 * | 4.5899 | -1.5042 | 20.2029 | -6.8046 | 25.5033 | . | . |

| OBS | ID | STUDENT RESIDUAL | -2 -1 0 1 2 | COOK'S D |
|---|---|---|---|---|
| 1 | . | . | | . |
| 2 | 78 | 1.0004 | \|  \|** \| | 0.694 |
| 3 | 79 | -1.2216 | \| **\|  \| | 0.115 |
| 4 | 80 | 0.1697 | \|  \|  \| | 0.002 |
| 5 | 81 | 0.7561 | \|  \|* \| | 0.068 |
| 6 | 82 | -1.2496 | \| **\|  \| | 0.265 |
| 7 | 83 | 1.2496 | \|  \|** \| | 0.265 |
| 8 | 84 | 1.2366 | \|  \|** \| | 0.074 |
| 9 | 85 | -0.5305 | \|  *\|  \| | 0.011 |
| 10 | 86 | -0.9811 | \|  *\|  \| | 0.744 |
| 11 | 87 | -0.9714 | \|  *\|  \| | 1.954 |
| 12 | 88 | -1.4729 | \| **\|  \| | 0.141 |
| 13 | 89 | 0.7556 | \|  \|* \| | 0.038 |
| 14 | 90 | 0.7126 | \|  \|* \| | 0.085 |
| 15 | 91 | . | | . |

SUM OF RESIDUALS 2.70806E-12
SUM OF SQUARED RESIDUALS 179.2104
PREDICTED RESID SS (PRESS) 1022.024

DURBIN-WATSON D 2.279
(FOR NUMBER OF OBS.) 15
1ST ORDER AUTOCORRELATION -0.171

Step 5 - First part of the ALERT model run - Step C.

For those weapon systems that you may need to make additional program runs on, an individual weapon system program the same as the RLA.ALERT1B is provided. Simply follow the same steps as provided for in step 4 above. The program's name is RLA.ALERT1C.

Step 6 - Second part of the ALERT model run - Step A.

The purpose for the second part of the ALERT model run is to select the projection for the BP15 POM outyears. Step A computes all the possible R-square values for all combinations of the regression variables. From these you will select a "library" of possible regression equations to model the BP15 POM outyear projections in step 7. The main SAS procedure executed for each weapon system is as follows:

```
PROC RSQUARE CP;
    MODEL POSBES = DUMMY DUMMY2 VALUE YEAR AGEREC;
```

Fetch the ALERT model, RLA.ALERT2A, to your AWS computer space. Your computer screen should appear as follows:

```
>
> AWS(RLA.ALERT2A)     SCRL FULL COLS 00001 00072 PAU(    .SYNON)
>
<...+....1....+....2....+....3....+....4....+....5....+....6....+..
 ......  ============================== T O P ====================
 000100  //PPB5RLA2  JOB (00000,LCA),'BIN84 LUCAS 75249',
 000200  //     CLASS=A,MSGCLASS=X,NOTIFY=ROS1RLA
 000300  //STATS      EXEC SAS,WORK='50,10'
 000400  //ALERTDB    DD DSN=PPB5GRP.ALERT.JUN88,DISP=SHR
 000500  //SYSPRINT   DD   SYSOUT=*
 000600
 000700       /*****************************************/
 000800       /*                                       */
 000900       /*         SECOND ALERT PROGRAM          */
 000000       /*                STEP A                 */
 001100       /*               (ALERT2A)               */
 001200       /*                                       */
 001300       /*****************************************/
```

You will need to update the bold characters as you did in step 3. No further modifications are necessary unless you are adding or deleting weapon systems from the ALERT model runs.

Submit this program to the job stream as you did in step 3.

On the following page is the output for RLA.ALERT2A, Step A for FY88. As is step 3, your objective is to select the models that have a high R-square and a low C(P) value. (If you remember what you did in step 3, you can skip the rest of this step.) For each type of model (i.e., one variable, two variables, three variables, etc.), there appears to be a natural break where the R-square and C(P) values suddenly change and get worse. These natural breaks are indicated by the straight lines that we've drawn. Those models below the lines are candidates for input in Step B (Step 7). We further narrowed the possible models to those indicated by the asterisks (*). Since the A-7 data base has nothing but zeros for the DUMMY2 variable, this variable is meaningless in the regression equations. Therefore, we eliminated all models that have this variable in it. Also, no regression equations can be dependent on the variables DUMMY and DUMMY2 alone. Therefore, we eliminated all such type models. The asterisked models are the ones that become the input to the next step.

Step 7 - Second part of the ALERT model run - Step B.

As we stated in step 6, the second part of the ALERT model run is to select the projection for the BP15 POM outyears. Step B computes all the regression equations for all the models we selected in step 6. This creates a "library" of possible regression equations to model the BP15 POM outyears.
Fetch the ALERT model, RLA.ALERT2B, to your AWS computer space. Your computer screen should appear as follows:

```
>
> AWS(RLA.ALERT2B)     SCRL FULL COLS 00001 00072 PAU(    .SYNON)
>
<...+....1....+....2....+....3....+....4....+....5....+....6....+..
 ......  ============================== T O P ====================
 000100  //PPB5RLA2  JOB (00000,LCA),'BIN84 LUCAS 75249',
 000200  //     CLASS=A,MSGCLASS=X,NOTIFY=ROS1RLA
 000300  //STATS      EXEC PROC=SAS,WORK='50,10'
 000400  //ALERTDB    DD DSN=PPB5GRP.ALERT.JUN88,DISP=SHR
 000500  //SYSPRINT   DD   SYSOUT=*
 000600
 000700       /*****************************************/
 000800       /*                                       */
 000900       /*          FIRST ALERT PROGRAM          */
 000000       /*               STEP B                  */
 001100       /*             (ALERT2B)                 */
 001200       /*                                       */
 001300       /*****************************************/
```

You will need to update the bold characters as you did in step 2.

N=14 REGRESSION MODELS FOR DEPENDENT VARIABLE: POSBES MODEL: MODEL1

| NUMBER IN MODEL | R-SQUARE | C(P) | VARIABLES IN MODEL |
|---|---|---|---|
| 1 | 0.00000000 | 113.608 | DUMMY2 |
| 1 | 0.00645096 | 112.810 | AGEREC |
| 1 | 0.01332843 | 111.960 | VALUE |
| 1 | 0.08885969 | 102.624 | YEAR |
| 1 | 0.77774600 | 17.472316 | DUMMY |
| 2 | 0.00645096 | 114.810 | DUMMY2 AGEREC |
| 2 | 0.01332843 | 113.960 | DUMMY2 VALUE |
| 2 | 0.02896684 | 112.027 | VALUE AGEREC |
| 2 | 0.08885969 | 104.624 | DUMMY2 YEAR |
| 2 | 0.30656942 | 77.713393 | VALUE YEAR |
| 2 | 0.48520407 | 55.632766 | YEAR AGEREC |
| 2 | 0.77774600 | 19.472316 | DUMMY DUMMY2 |
| 2 | 0.77782611 | 19.462415 | *DUMMY AGEREC |
| 2 | 0.78095164 | 19.076075 | *DUMMY VALUE |
| 2 | 0.79262886 | 17.632680 | *DUMMY YEAR |
| 3 | 0.02896684 | 114.027 | DUMMY2 VALUE AGEREC |
| 3 | 0.30656942 | 79.713393 | DUMMY2 VALUE YEAR |
| 3 | 0.48520407 | 57.632766 | DUMMY2 YEAR AGEREC |
| 3 | 0.48559143 | 57.584886 | VALUE YEAR AGEREC |
| 3 | 0.77782611 | 21.462415 | DUMMY DUMMY2 AGEREC |
| 3 | 0.78095164 | 21.076075 | DUMMY DUMMY2 VALUE |
| 3 | 0.79262886 | 19.632680 | DUMMY DUMMY2 YEAR |
| 3 | 0.81415674 | 16.971668 | *DUMMY VALUE AGEREC |
| 3 | 0.82448572 | 15.694926 | *DUMMY VALUE YEAR |
| 3 | 0.91970003 | 3.925698 | *DUMMY YEAR AGEREC |
| 4 | 0.48559143 | 59.584886 | DUMMY2 VALUE YEAR AGEREC |
| 4 | 0.81415674 | 18.971668 | DUMMY DUMMY2 VALUE AGEREC |
| 4 | 0.82448572 | 17.694926 | DUMMY DUMMY2 VALUE YEAR |
| 4 | 0.91970003 | 5.925698 | DUMMY DUMMY2 YEAR AGEREC |
| 4 | 0.92718903 | 5.000000 | *DUMMY VALUE YEAR AGEREC |
| 5 | 0.92718903 | 7.000000 | DUMMY DUMMY2 VALUE YEAR AGEREC |

The main SAS procedures executed for each weapon system is as follows:

```
PROC REG DATA=DBASE;
    ID YEAR;
    MODEL POSBES = DUMMY DUMMY2 VALUE YEAR AGEREC
      / P R CLI CLM DW;
OUTPUT OUT=ALERT
    P=FCST L95=L95 U95=U95 R=RESID COOKD=COOKD;
PROC PLOT DATA=ALERT;
    PLOT POSBES*YEAR='A' FCST*YEAR='F' U95*YEAR='U' L95*YEAR='L'
      / OVERLAY VPOS=32 HPOS=80;
```

The third line is the one you will vary for each model. Further modifications may be necessary as you incorporate the different ALERT models you selected in the last step into this ALERT program. You may need to add or delete the PROC statements above as necessary.

When you have completed making changes, submit this program to the job stream and output it as you did in step 2. An example of the output for the A-7 aircraft is included on the next three pages.

The same five criteria you used in step 4 you will use here to decide which is the optimum model for forecasting the POM outyears. They are, the adjusted R-square value, the *F* statistic, the residuals, the Durbin-Watson statistic, and subjective judgement. If the other tests are reasonable, subjective judgement plays heavily in the decision making as knowledge of future trends and circumstances not reflected in historical data will determine which model is the best to use. MMMCS should be involved in this decision making process as they are the end user of the ALERT model results.

Step 8 - Second part of the ALERT model run - Step C.

For those weapon systems that you may need to make additional program runs on, an individual weapon system program the same as the RLA.ALERT2B is provided. Simply follow the same steps as provided for in step 8 above. The program's name is RLA.ALERT2C.

DEP VARIABLE: POSBES BP15 POS BES

ANALYSIS OF VARIANCE

| SOURCE | DF | SUM OF SQUARES | MEAN SQUARE | F VALUE | PROB>F |
|---|---|---|---|---|---|
| MODEL | 2 | 2309.52801 | 1154.76400 | 21.022 | 0.0002 |
| ERROR | 11 | 604.22913 | 54.92992135 | | |
| C TOTAL | 13 | 2913.75714 | | | |

| | | | |
|---|---|---|---|
| ROOT MSE | 7.411472 | R-SQUARE | 0.7926 |
| DEP MEAN | 21.58571 | ADJ R-SQ | 0.7549 |
| C.V. | 34.33508 | | |

PARAMETER ESTIMATES

| VARIABLE | DF | PARAMETER ESTIMATE | STANDARD ERROR | T FOR H0: PARAMETER=0 | PROB > \|T\| | VARIABLE LABEL |
|---|---|---|---|---|---|---|
| INTERCEP | 1 | 54.21346448 | 42.62110412 | 1.272 | 0.2296 | INTERCEPT |
| DUMMY | 1 | 35.31804813 | 5.78041991 | 6.110 | 0.0001 | INFLATION SURROGATE |
| YEAR | 1 | -0.44583652 | 0.50177647 | -0.889 | 0.3933 | AY YEAR |

| OBS | ID | ACTUAL | PREDICT VALUE | STD ERR PREDICT | LOWER95% MEAN | UPPER95% MEAN | LOWER95% PREDICT | UPPER95% PREDICT | RESIDUAL | STD ERR RESIDUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | . | . | . | . | . | . | . | . | . | . |
| 2 | 78 | 7.0000 | 19.4382 | 4.0416 | 10.5428 | 28.3337 | 0.8579 | 38.0186 | -12.4382 | 6.2125 |
| 3 | 79 | 14.5000 | 18.9924 | 3.6256 | 11.0125 | 26.9723 | 0.8325 | 37.1522 | -4.4924 | 6.4641 |
| 4 | 80 | 21.1000 | 18.5465 | 3.2341 | 11.4283 | 25.6648 | 0.7485 | 36.3446 | 2.5535 | 6.6686 |
| 5 | 81 | 30.7000 | 18.1007 | 2.8770 | 11.7684 | 24.4330 | 0.6022 | 35.5993 | 12.5993 | 6.8303 |
| 6 | 82 | 48.2000 | 52.9729 | 5.2467 | 41.4250 | 64.5209 | 32.9865 | 72.9593 | -4.7729 | 5.2347 |
| 7 | 83 | 57.3000 | 52.5271 | 5.2467 | 40.9791 | 64.0750 | 32.5407 | 72.5135 | 4.7729 | 5.2347 |
| 8 | 84 | 28.4000 | 16.7632 | 2.1800 | 11.9651 | 21.5613 | -0.2404 | 33.7668 | 11.6368 | 7.0836 |
| 9 | 85 | 20.3000 | 16.3174 | 2.1411 | 11.6047 | 21.0300 | -0.6623 | 33.2971 | 3.9826 | 7.0955 |
| 10 | 86 | 11.8000 | 15.8715 | 2.2182 | 10.9894 | 20.7537 | -1.1560 | 32.8990 | -4.0715 | 7.0718 |
| 11 | 87 | 14.2000 | 15.4257 | 2.3999 | 10.1436 | 20.7078 | -1.7208 | 32.5722 | -1.2257 | 7.0122 |
| 12 | 88 | 9.6000 | 14.9799 | 2.6650 | 9.1142 | 20.8455 | -2.3553 | 32.3150 | -5.3799 | 6.9158 |
| 13 | 89 | 15.7000 | 14.5340 | 2.9914 | 7.9499 | 21.1181 | -3.0572 | 32.1253 | 1.1660 | 6.7809 |
| 14 | 90 | 14.1000 | 14.0882 | 3.3613 | 6.6899 | 21.4865 | -3.8237 | 32.0001 | 0.0118 | 6.6054 |
| 15 | 91 | 9.3000 | 13.6423 | 3.7619 | 5.3624 | 21.9223 | -4.6513 | 31.9360 | -4.3423 | 6.3858 |
| 16 | 92 | . | 13.1965 | 4.1844 | 3.9867 | 22.4063 | -5.5364 | 31.9294 | . | . |
| 17 | 93 | . | 12.7507 | 4.6227 | 2.5760 | 22.9253 | -6.4749 | 31.9763 | . | . |
| 18 | 94 | . | 12.3048 | 5.0729 | 1.1395 | 23.4702 | -7.4630 | 32.0726 | . | . |
| 19 | 95 | . | 11.8590 | 5.5319 | -0.3166 | 24.0346 | -8.4965 | 32.2145 | . | . |
| 20 | 96 | . | 11.4132 | 5.9978 | -1.7879 | 24.6142 | -9.5718 | 32.3981 | . | . |

AIR LOGISTICS EARLY REQUIREMENTS TECHNIQUE
A-7 FORECAST
BP15 POS

13:32 WEDNESDAY, NOVEMBER 23, 1988

| OBS | ID | ACTUAL | PREDICT VALUE | STD ERR PREDICT | LOWER95% MEAN | UPPER95% MEAN | LOWER95% PREDICT | UPPER95% PREDICT | RESIDUAL | STD ERR RESIDUAL |
|---|---|---|---|---|---|---|---|---|---|---|
| 21 | 97 | . | 10.9673 | 6.4690 | -3.2709 | 25.2055 | -10.6851 | 32.6198 | . | . |

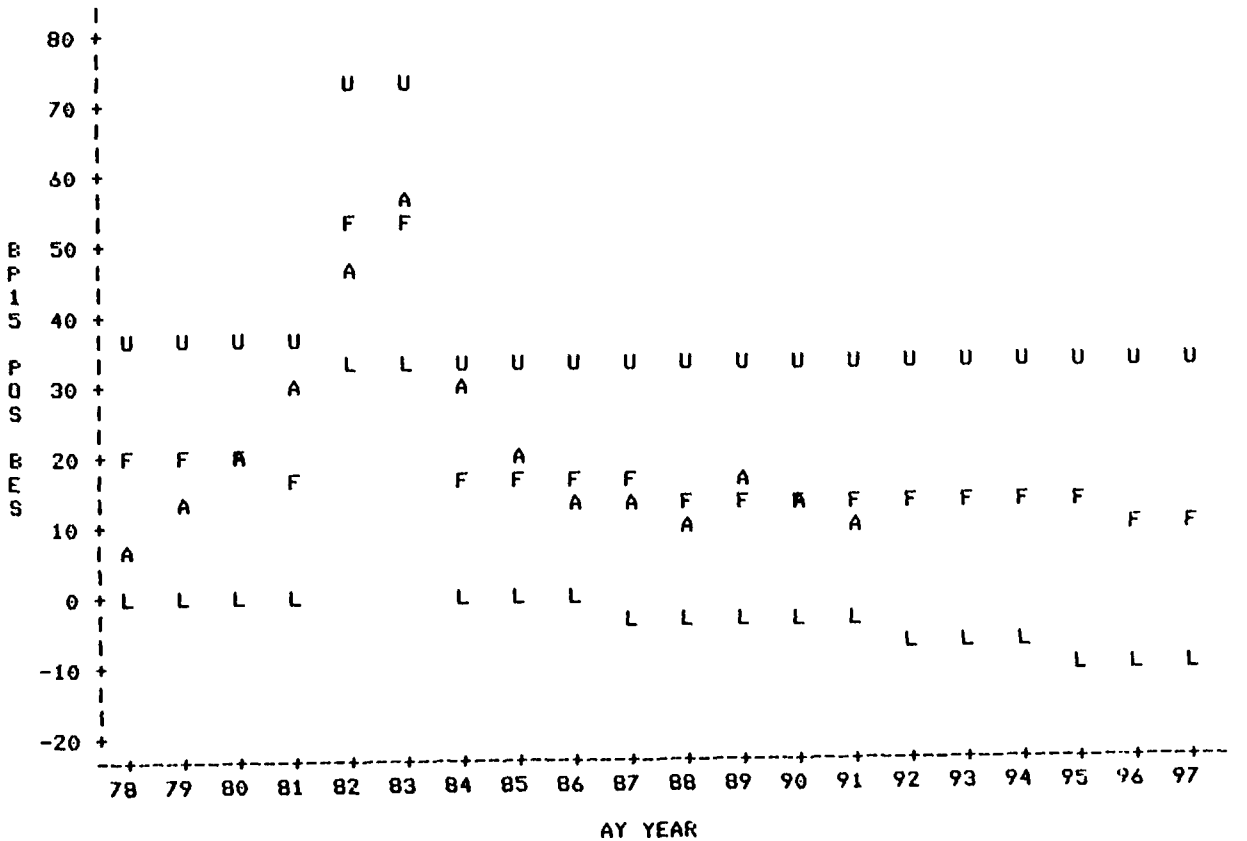
| OBS | ID | STUDENT RESIDUAL | -2 -1 0 1 2 | COOK'S D |
|---|---|---|---|---|
| 1 | . | . | | . |
| 2 | 78 | -2.0021 | \|  xxxx\|  \| | 0.565 |
| 3 | 79 | -0.6950 | \|  x\|  \| | 0.051 |
| 4 | 80 | 0.3829 | \|  \|  \| | 0.011 |
| 5 | 81 | 1.8446 | \|  \|xxx \| | 0.201 |
| 6 | 82 | -0.9118 | \|  x\|  \| | 0.278 |
| 7 | 83 | 0.9118 | \|  \|x \| | 0.278 |
| 8 | 84 | 1.6428 | \|  \|xxx \| | 0.085 |
| 9 | 85 | 0.5613 | \|  \|x \| | 0.010 |
| 10 | 86 | -0.5757 | \|  x\|  \| | 0.011 |
| 11 | 87 | -0.1748 | \|  \|  \| | 0.001 |
| 12 | 88 | -0.7779 | \|  x\|  \| | 0.030 |
| 13 | 89 | 0.1720 | \|  \|  \| | 0.002 |
| 14 | 90 | .0017897 | \|  \|  \| | 0.000 |
| 15 | 91 | -0.6800 | \|  x\|  \| | 0.053 |
| 16 | 92 | . | | . |
| 17 | 93 | . | | . |
| 18 | 94 | . | | . |
| 19 | 95 | . | | . |
| 20 | 96 | . | | . |
| 21 | 97 | . | | . |

| | |
|---|---|
| SUM OF RESIDUALS | 2.55795E-13 |
| SUM OF SQUARED RESIDUALS | 604.2291 |
| PREDICTED RESID SS (PRESS) | 1038.715 |
| DURBIN-WATSON D | 1.433 |
| (FOR NUMBER OF OBS.) | 14 |
| 1ST ORDER AUTOCORRELATION | 0.140 |

AIR LOGISTICS EARLY REQUIREMENTS TECHNIQUE
A-7 FORECAST
BP15 POS

13:32 WEDNESDAY, NOVEMBER 23, 1988

PLOT OF POSBES*YEAR SYMBOL USED IS A
PLOT OF FCST*YEAR SYMBOL USED IS F
PLOT OF U95*YEAR SYMBOL USED IS U
PLOT OF L95*YEAR SYMBOL USED IS L




NOTE: 10 OBS HAD MISSING VALUES

## REFERENCES

1. Rexroad, Adrienne, Larry Collins, and Rob Lucas, "Air Logistics Early Requirements Technique (ALERT) FY90-94 Program Objective Memorandum (POM) Forecasts," HQ AFLC/MMMA Technical Report, January 1989.

2. Lucas, Rob, Adrienne Rexroad, and Larry Collins, "Air Logistics Early Requirements Technique (ALERT) FY92-97 Program Objective Memorandum (POM) Forecasts," HQ AFLC/MMMA Technical Report, March 1989.

3. Lucas, Rob and Larry Collins, "Transfer of the Air Logistics Early Requirements Technique (ALERT) Forecasting Model from the CREATE Computer System to the Requirements Data Bank (RDB) Computer System," HQ AFLC/MMMA Technical Report, January 1989.

4. Stakton, John R. Introduction to Business and Economic Statistics, 3rd ed. South-Western Publishing Company, 1966.

5. SAS Institute Inc. SAS User's Guide: Statistics, Version 5 Edition. Cary, NC: SAS Institute Inc., 1985.

6. Wesolowsky, George O. Multiple Regression and Analysis of Variance. John Wiley and Sons, Inc., 1976.

# APPENDIX A

## SYSTEM MANAGEMENT CODES (SMC) USED IN THE AIR LOGISTICS EARLY REQUIREMENTS TECHNIQUE (ALERT) FORECASTING MODEL

# APPENDIX A

## System Management Codes (SMC) used in the Air Logistics Early Requirements Technique (ALERT) Forecasting Model

This appendix lists the SMC codes used to identify the appropriate weapon system funds within the D041 Central Secondary Item Stratification (CSIS) reports on the Requirements Data Bank (RDB) computer system. These SMC codes are current as of the 1988 ALERT model forecast for the BP15 POM. We present these codes to the BP15 budget managers to review and update, as necessary, before we make the ALERT based forecasts.

## ALERT SMC CODES

| MISSION DESIGN | SMC |
|---|---|
| A-7 | 337A |
| A-10 | 329A |
| | 329E |
| | 329F |
| B-1 | B01B |
| | B01E |
| | 661P |
| B-52 | 101D |
| | 101G |
| | 101H |
| | 101Z |
| | 608P |
| | 615P |
| | 616P |
| | 617P |
| | 635P |
| | 636P |
| | 650P |
| | 652P |
| | 669P |
| | 676P |
| | 677P |
| | 722P |
| | 725P |
| | 731P |
| | 732P |
| C-5 | 410A |
| | 410E |
| C-130 | 400H |
| | 400Z |
| | 632P |
| C-135 | 119Y |
| | 119Z |
| | 119E |
| | 119F |
| | 679P |
| C-141 | 476L |
| | 476E |
| COMMON | 619P |

| MISSION DESIGN | SMC |
|---|---|
| COMMON | 634P |
| | 639P |
| | 644P |
| | 645P |
| | 650C |
| | 650P |
| | 651C |
| | 651P |
| | 655P |
| | 660P |
| | 665P |
| | 666P |
| | 668P |
| | 671P |
| | 674P |
| | 678P |
| | 684P |
| | 695P |
| | 697P |
| | 705P |
| | 732P |
| | 733P |
| | 9999 |
| | 999A |
| | 999B |
| | 999C |
| | 999F |
| | 999H |
| | 999T |
| | 999U |
| | 999V |
| E-3 | 411Z |
| | 411E |
| F-4 | 327Z |
| | 638P |
| | 649P |
| | 682P |
| | 685P |
| | 730P |

| MISSION DESIGN | SMC |
|---|---|
| F-15 | 328A |
| | 328B |
| | 328C |
| | 328D |
| | 328Z |
| | 640P |
| | 654P |
| | 656P |
| | 672P |
| | 692P |
| F-16 | 687P |
| | F16A |
| | F16B |
| | F16C |
| | F16D |
| | F16Z |
| F-111 | 129A |
| | 324A |
| | 324D |
| | 324E |
| | 324F |
| | 324L |
| | 324Z |
| | 635P |
| | 637P |
| | 642P |
| | 647P |
| | 657P |
| | 673P |
| | 728P |
| | 729P |
| | 735P |
| F100 | 328E |
| | 380A |
| | 380B |
| | 380E |
| | 380N |
| | F16N |